

SOCIAL ROBOTS, INC.

Prasad Padmanabhan, St. Mary's University

CASE DESCRIPTION

The case deals with the topic of currency hedging and can be used in a basic course in International Finance at the undergraduate or graduate level. Before assigning this case, it is assumed that the following topics have been covered in class: basic exchange rate concepts and terminology, basic international derivative instruments (forward markets, put and call options), and the concept of money market hedges. The level of difficulty can be adjusted to suit the needs of the instructor and the availability of class time to cover these topics (described below under case description). Ideally, the complete case can be assigned as a homework project and can be covered in one 90 minute of class time. Students have indicated that they have spent approximately 4 hours preparing the case in a group.

CASE SYNOPSIS

A US based firm was buying robots from a US based supplier but now is faced with a problem when the supplier decides to raise prices. The CEO has to decide between alternate suppliers in China and South Korea. Unfortunately, this involves dealing with exchange rates and creates exchange risk. A late entry from another US supplier creates a third opportunity for purchase. Students are required to consider different hedging alternatives (forward markets, money market hedges, and options). Payment is also made at different intervals. Students are required to select the best method by maturity and evaluate costs against another proposal by a US based supplier. Opportunity is provided for exploring whether “upfront” payment is better if a discount is offered as well as whether changes in the cost of capital influence hedging choices. Instructors can also assign this case using piecemeal hedging choices, thereby varying the level of difficulty of the case. Finally, they can easily convert this importing problem into an exporting one.

Students are exposed to a real world type dilemma when they compute exchange exposures in different currencies and learn about the different methods of currency hedging (forward market hedge, options market hedge, money market hedge). They will also realize that they should seek the best method by maturity since it maybe that the forward works best for 60 days but the options prove better for 180 days. Since both puts and calls information is provided, the student is allowed to decide which instrument is more appropriate in this case. Similarly, they also get to decide if a bid or an ask quote is relevant, or, for the money market hedge, whether they should consider borrowing or lending. They can also learn more about options – some options seem feasible but on closer examination, have already expired and cannot be used in this instance. Finally, students get to explore other aspects of the case, such as, quality considerations, insurance cost when in transit, after sales service, etc. Students can also be exposed to international negotiations. Can they pit one exporter against another?

INSTRUCTORS' NOTES

RECOMMENDATIONS FOR TEACHING APPROACHES

How Should The Case Be Used?

The instructor should first cover the basics of what the different hedging instruments are all about. They should also teach students the differences between hedging where the firm exports to a foreign currency (an Accounts Receivable problem) vs. where the firm imports (a Accounts Payable problem) from a foreign country. Here the three available hedging techniques are briefly introduced in the context where the firm imports from a foreign country.

- a) *Forward Market Hedge*: Buy a forward contract to buy foreign currency forward (ask rates). Compute the present value of the cost of this forward contract. Note all interest rates and the cost of capital are expressed as percentage rates per year.
- b) *Money Market Hedge*: Exchange money at current spot (ask) rates and invest (lend rates) for the required maturity. Again, the amount needed today in US dollars is the present value of the amount that need to be paid at the required maturity, discounted by the lend rate.
- c) *Options*: Call options are useful since the firm needs to buy foreign currency. The beauty of options is that the firm need not exercise these options if the spot price at maturity is better cost wise than when using options. Hence options payoffs are contingent payoffs. Since the cost under this alternative depends on the realized future exchange rate, we can only compute a *maximum* cost, which is when we exercise the option (costs cannot be higher than this floor). The firm pays upfront for the cost of the option (option premiums are expressed as a percentage of the strike price) and assumed exercised at maturity. The value in dollars at maturity is then discounted to present value using the cost of capital and the option premium *added* to this value since it is an added cost.

After computation of the costs under each hedging method *for each maturity*, the firm should select the one that provides the least cost hedge. This process is repeated for each maturity and the cost under the best alternative for each maturity is added to generate the present value of total costs of the purchase for each alternative. Note that the present value of total costs will differ for each alternative country (Korea or China). The Chinese purchase introduces another wrinkle in that they demand payment in Yuan and in Euros. This is a minor complication – the computational process remains the same. Another issue that students must recognize is that some stated call options cannot be used because they will have already expired when the payables are due.

After class coverage of the basic concepts, the instructor can assign the case as one big case or split it up as three separate sub cases. The choice depends on the amount of time available to the instructor. But prior to assignment, the instructor should provide a basic format (in Excel) on how students should solve the case (see Excel spreadsheet solutions). They should be asked to use cell referencing methodology under Excel since this allows students to “play” with the numbers.

As a first step, the instructor should ensure that all students understand what the case is about. Clearly, the firm needs to decide where to buy the robots. Since some of the alternatives include purchasing from foreign countries, exchange risk is involved. A final alternative to buy from another US supplier is also presented. Is the optimal alternative to buy from the cheapest foreign supplier or from the alternate domestic supplier? Interesting discussion will center on quality considerations and delivery reliability. Are the foreign robots of the same quality as US made robots? What about insurance related issues? What if a robot was defective? Does the exporter have facilities located in the US to handle repairs as needed? Shipping to foreign locations can be cumbersome and these aspects should be taken into account before making a purchase decision. A third issue would involve considerations of whether this purchase is a one-time purchase or the basis of repeat purchases. Final decisions should incorporate these additional considerations. However, the instructor is left to explore these issues with students since only the basic numerical solutions will be provided here.

Next, time permitting, the instructor can *sequentially* allow for the different hedging techniques. A unique feature of the case is that instructors can “adjust” the difficulty level depending on their needs. A simple version can be used (with a difficulty level 1) at the beginning and the complexity level increased at the discretion of the instructor. For instance, the case allows students to select the best hedging method for different maturities from a menu of three different choices (forward, money market, options). Initially, the instructor can ask students to ignore all hedging methods except for the forward rate method and select the best hedging alternative. Next, they may be told to determine the best hedging alternative from using only the money market alternative, followed by the options alternative. In addition, the US based firm has options to import from two foreign countries. The instructor can ask students to focus only on one country at a time. Alternatively, the instructor can assign this case (ideally in a graduate basic course in international finance) in its entirety and allow students to determine the best outcome. Students may then be asked to determine any qualitative considerations that may be relevant to the decision. As suggested above, students will be able to grapple with the issue of quality considerations. If they decide that importing from China is the best one, then can the Chinese meet the quality requirements? How critical are quality considerations for the importing firm? For graduate students, instructors can explore if it makes sense for the firm *not* to hedge. A big firm with many export and import contracts over a period may be better off not hedging since hedging costs real money and on average they break even if they do not hedge. A small firm may be better off hedging such risks since they may lose their small profit margins if exchange rates move unfavorably.

Next, they get to decide if paying the entire amount is a better alternative if the seller provides an attractive discount. How high should the discount be to make paying upfront (over the hedging alternative) more attractive? Another aspect is the issue of the uncertainty with the cost of capital in terms of influencing the decision. Will this uncertainty influence the final decision? What if there was an error in estimating the cost of capital? Are the final results sensitive to the choice of cost of capital? The student can explore this area as well. Students should be encouraged to perform computations in Excel since they can easily change numbers and instantaneously see the impact of these changes on results. A small (but important) byproduct is that students secure valuable exposure in the use of Excel spreadsheets.

Instructors can easily change the “case numbers” (provided they make economic sense) to ensure that they can use this case in multiple classes without losing value when students in different classes can “share” results with each other.

Finally, the case is that it can be turned on its head and converted into an exporting problem using the same data – what if the US firm was selling robots and foreign buyers were interested?

Class discussion can center on the numerical solutions. Once this is covered, the instructor can “play” with changing the cost of capital information and see what this does to the choices. Finally, the instructor can ask if quality of imported products is important. If China can offer cheaper prices but are of lower quality than those from South Korea, how should the purchase decision be strategically made? This provides scope for ample discussion in class. The importance of proper exchange rate forecasting can also be introduced in class since this can have a bearing on the final strategy. As illustrated earlier, instructions can address the issue of whether this is a one-time decision, or a multi-period one. What about shipment disasters if imported from abroad? Is there value to buying higher priced domestic products to avoid these problems? Discussions surrounding who pays for the insurance when shipment is in transit, etc. can be raised, but is not central to the case.

Solution

The attached Excel spreadsheet is self-explanatory and indicates that the Chinese purchase is the optimal one, especially with the discount offered. However, quality and shipping considerations remain.

Attached: Excel spreadsheet (embedded in word) containing solutions outline is available below. Actual excel spreadsheet is available on request from the authors.

Social Robots, Inc

Prasad - Solutions outline

© Prasad Padmanabhan

INPUT

No. of units	500					
Chinese Price/unit	60000	Yuan				
South Korean Price/unit	12000000	Won				
US price (new); \$/unit	\$9,500.00					
cost of capital	8%					
Down payment (Chinese)	50%					
payment per period (Korea)	25%					
exchange rates	spot	spot	30	30	60	60
(Direct quotes in the US)	Bid	Ask	Bid	Ask	Bid	Ask
Chinese Yuan	0.1613	0.1625	0.17	0.1725	0.1722	0.1752

Euro	1.3327	1.3356	1.331	1.332	1.33	1.3312
			Bid	Ask	Bid	Ask
	spot	spot	60	60	120	120
South Korean Won	0.00089	0.00092	0.00079	0.00082	0.00072	0.00075
South Korean Won	Bid	Ask	Bid	Ask		
	180	180	240	240		
	0.00068	0.00071	0.00065	0.00069		
borrowing lending						
	period	B	L			
Chinese Yuan	30	7%	6%			
	60	7.50%	6.25%			
Euro	30	4.25%	3.75%			
	60	5.20%	4.10%			
South Korean Won	60	3%	2.20%			
	120	3.50%	2.60%			
	180	3.75%	2.80%			
	240	4%	3%			
US	30	1.50%	1%			
	60	1.60%	1.10%			
	120	1.65%	1.20%			
	180	1.70%	1.30%			
	240	1.90%	1.42%			
Options	period	Put	Call	Option Premium		
		St. Price	St. Price			
Chinese Yuan	90		0.1611	5%		
	90	0.1611		8%		
	30		0.1611	3%		
Euro	30		1.34	10%		
	60	1.34		8%		
South Korean Won	60		0.0007	4%		
	90		0.00075	6%		
	240	0.0078		9%		

Solutions

CHINESE CASE

DOWN PAYMENT (\$) \$2,437,500.00

	Yuan	Euro
FUTURE PAYMENTS	30	60
FORWARD	\$1,285,182.12	\$1,198,751.60
MONEY MARKET	\$1,212,686.57	\$906,318.06
OPTIONS	\$1,228,599.47	

	optimum	\$1,212,686.57	\$906,318.06		
TOTAL COST (PV\$)		\$4,556,504.62			
SOUTH KOREAN CASE					
DOWN PAYMENT (\$)		0			
FUTURE PAYMENTS	TYPE	60	120	180	240
	FORWARD	\$1,213,815.79	\$1,095,779.22	\$1,024,038.46	\$982,594.94
	MONEY MARKET	\$1,374,958.49	\$1,368,142.76	\$1,360,946.75	\$1,352,941.18
	OPTIONS	\$1,078,184.21			
	optimum	\$1,078,184.21	\$1,095,779.22	\$1,024,038.46	\$982,594.94
TOTAL COST (PV\$)		\$4,180,596.83			
US SUPPLIER COST (\$)		\$4,750,000.00			
Best Alternative?		\$4,180,596.83			
		Korean offer is best			
Accept discount?					
Min acceptable discount?		0.142441676			
since 15% is greater than this,					
Accept Chinese discount					
Final recommendation					
Chinese offer with discount is best					
if only forward hedge is considered:					
Chinese imports		\$4,921,433.72			
Korean imports		\$4,316,228.41			
US supplier		\$4,750,000.00			
Korean imports are best					
If only money market hedge is considered					
Chinese imports		\$4,556,504.62			
Korean imports		\$5,456,989.17			
US supplier		\$4,750,000.00			

Chinese imports are best

Options only situations are not applicable since this alternative is unavailable in many cases

QUESTIONS FOR CLASS DISCUSSION

1. What if the firm is restricted to using only the forward markets to hedge exchange risk?

Based on the excel spreadsheet, firm is better off importing from the Korean firm since the present value of costs are the lowest.

The calculations for the 30 day transaction are shown below; the equations for the other maturities are similar to the one for the 30 day maturity and if the solution cell is highlighted, the equation shows up in the spreadsheet.

*Present Value (PV: Forward market hedge, 30 days, Chinese case) = $[0.25 * 500 \text{ units} * 60,000 \text{ (Price per unit)} * 0.1725 \text{ (30 day forward ask exchange rate, \$/Yuan)}] / [(1 + (0.08/360)*30)] = \$ 1,285,182.12.$*

Note that since the down payments are different for each of the Korean and Chinese imports, these must be added to the best forward market hedges for the different maturities to compute the cost under each alternative.

Based on the excel solutions provided and if only forward market hedges are allowed, then importing from Korea is the least cost alternative. Total cost = \$4,316,228.41

2. What if the firm is restricted to using only the money markets to hedge exchange risk?

*PV (Money market hedge, 30 days, Chinese case) = $[0.25 * 500 \text{ units} * 60,000 \text{ (Price per unit)} * 0.1625 \text{ (Spot ask exchange rate, \$/Yuan)}] / [(1 + (0.06/360)*30)] = \$ 1,212, 685.57.$*

Again, down payments must be added and then the best alternative determined. Based on the excel solutions provided and if only money market hedges are allowed, then importing from China is the least cost alternative. Total cost = \$4,556,504.62.

Obviously, it is clear that the pure options case cannot be considered since it is only available for a few alternatives.

Instructors can then enter into discussions related to quality/delivery reliability considerations. Other issues include customs duties, responsibility for insurance when in transit, etc. In addition, issues related to after sales service will also be relevant and important.

Even though the pure options alternative is discounted as a viable alternative, computations for one of the cases are provided below: (Chinese, 30 day case, call options).

Maximum Present Value:

*$[0.25 * 500 * 60,000 * 0.1611 \text{ (\$/Yuan, call options strike price)}] / [(1 + (0.08 \text{ (cost of capital)} / 360) * 30)] + [[0.25 * 500 * 60,000 * 0.1611 * 0.03 \text{ (option premium)}]. = \$1,228,599.47.$*

Note that since call options are contingent payoffs, we can only know the maximum cost under this alternative. Also note that the second part of this equation is the cost to buy the call option and is paid at time 0.

3. What is the best alternative if there are no restrictions on the various alternatives available for hedging currency risk?

Since the computational methods are already described above, only the final decision (from the excel calculations) will be presented below.

Based on the excel spreadsheet solutions, it seems that the least cost hedging alternative is:

The Korean offer: \$ 4,180,596.83. This is the cheapest alternative. Under each table the specific hedge method (forward, money market, options if available) is specified.

As indicated earlier, students can be engaged in conversations related to the other aspects of the case (quality considerations, etc.).

4. Since the Chinese offered a 15% discount of all amounts were paid at time 0, should this offer be accepted?

Clearly, this offer must be compared to the next best alternative that the firm can do without the discount. Since this is the Korean offer, the discounted price must be lower than the Korean price for it to be attractive. The solution is to first compute the minimum discount that is acceptable to the importing firm. Let it be X %.

It is clear that the Chinese offer will be preferred if:

$$500 * 60000 * 0.1625 \text{ (the spot exchange rate) } (1-X) \leq \$ 4,180,596.83.$$

$$\text{Or, } \$ 4,875,000 (1-X) \leq \$ 4,180,596.83.$$

$$\text{Or, } (1-X) \leq 0.857558324. \text{ Hence, } X \Rightarrow 14.24\% \text{ for the pay up front offer to be attractive.}$$

Since 15% is greater than 14.24, it will be beneficial for the firm to consider the offer. However, a few other issues will surface. Does the importing firm have the cash flow to pay everything upfront? What if the firm took this potential offer to the Koreans and invited them to make a better offer? This issue provides rich material for a useful introduction to international negotiations as well.